

UNDERGROUND OUTLET

(Feet)
Code 620

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

A conduit installed beneath the surface of the ground to collect surface water and convey it to a suitable outlet.

II. Purpose

To dispose of excess water from terraces, diversions, subsurface drains, surface drains, trickle tubes or principal spillways from dams (outside the dam area only), or other concentrations without causing damage by erosion or flooding.

III. Conditions Where Practice Applies

This practice applies where:

- Excess surface water needs to be disposed of.
- A buried outlet is needed for diversions, terraces, or similar practices.
- An underground outlet can be installed that will safely dispose of excess water.
- Surface outlets are impractical because of stability problems, climatic conditions, land use, or equipment traffic.

IV. Federal, State, and Local Laws

Users of this standard should be aware of potentially applicable federal, state and local laws, rules, regulations or permit requirements governing underground outlets. This standard does not contain the text of federal, state, or local laws.

V. Criteria

The following criteria apply to all purposes.

A. Capacity

The underground outlet shall be designed, alone or in combination with other practices, with adequate capacity to insure that the terrace,

diversion, or other practices function according to the standard for the specific practice.

The capacity of the underground outlet for natural or constructed basins shall be adequate for the intended purpose without causing excessive damage to crops, vegetation, or improvements. The outlet shall remove the runoff from a 10-year frequency, 24-hour duration storm within 48 hours.

B. Inlet

An inlet can be a collection box, a perforated riser, a blind inlet (gravel), or other appropriate device. Its capacity shall be adequate to provide the maximum design flow in the conduit. Collection boxes must be large enough to facilitate maintenance and cleaning operations. Flow-control devices shall be installed as necessary.

Perforated risers must be of durable material, structurally sound, and resistant to damage by rodents or other animals.

If burning of vegetation is likely to create a fire hazard, the inlet shall be fire resistant.

The inlet must have an appropriate trash guard to insure that trash or other debris entering the inlet passes through the conduit without plugging. It must also have an animal guard to prevent the entry of rodents or other animals.

Vertical inlets shall be constructed of rigid material which does not require supplemental support to remain in a vertical position. Materials which meet these requirements include the following:

1. Corrugated metal pipe, galvanized or aluminum, 16 gauge.
2. Smooth steel pipe with 3/16-inch minimum thickness.

3. Smooth plastic pipe, polyvinyl chloride (PVC), with an SDR of 43 or less.
4. Round high-density polyethylene pipe (PE) shall have an SDR of 43 or less. Square PE intakes shall have minimum wall thickness as shown in the following table:

Table 1
Minimum Intake Wall Thickness

Intake Nominal Size (inches)	Wall Thickness (inches)
6	0.16
8	0.21
10	0.26
12	0.31

Pressure-relief wells shall be designed and installed as needed to control pressure. If junction boxes and other structures are needed, they shall be designed and installed in a manner that facilitates cleaning and other maintenance activities.

C. Hydraulics

Underground outlets shall be continuous conduits, tubing, or tile. Joints shall be hydraulically smooth, and the materials and methods used shall be recommended by the manufacturer. If a pressure system is used, joints shall be adequate to withstand the design pressure, including surges and vacuum. The maximum velocity must not exceed the safe velocity for the conduit materials and installation.

Lines shall be adequate to carry the design flow when the outlet and all inlets are operating at design capacity. Positive grade shall be maintained in all sections of an underground outlet. Capacity shall be based on the pipe size or on other flow control devices to prevent water from the upper inlets from discharging through the lower inlets. The minimum conduit diameter shall be 4 inches.

D. Materials

Materials shall meet or exceed the design requirements against leakage and shall withstand internal pressure or vacuum and external loading.

Plastic, concrete, aluminum, and steel shall meet the requirements specified in the applicable ASTM standard. All materials specified in the NRCS Field Office Technical Guide (FOTG), Section IV, Standard 606, Subsurface Drain, can be used for underground outlets. Conduits can be perforated or non-perforated, depending on the design requirements. A filter fabric wrap (sock) or equivalent shall be used if migration of soil particles around conduit is anticipated.

All plastic and polyethylene inlets shall include an ultraviolet stabilizer to protect them from solar degradation.

E. Outlet

The outlet shall be sufficiently stable for all anticipated flow conditions. It shall be designed for the maximum anticipated water surface at design flow.

A continuous section of closed conduit or a headwall will be used at the outlet. If a closed conduit is used, it shall be durable and strong enough to withstand all anticipated loads, including those caused by ice.

Outlet sections of closed conduits shall consist of corrugated metal, plastic, or other durable materials. Minimum outlet section lengths shall be as shown in the following table:

Table 2
Minimum Outlet Lengths

Drain Size (inches)	Outlet Length (feet)
4, 5	10
6, 8	16
10 and larger	20

Outlets shall not be placed in areas of active erosion. If fire is a hazard, the outlet shall be fire resistant.

All outlets must have animal guards to prevent the entry of rodents or other animals. Animal guards must be hinged to allow passage of debris.

F. Protection

All disturbed areas shall be reshaped and regraded so that they blend with the surrounding land features and conditions.

Visual resources must be given the same consideration as other design features.

Areas that are not to be farmed or covered by structural works shall be established to vegetation according to NRCS FOTG Standard 342, Critical Area Planting, or otherwise protected from erosion as soon as practicable after construction.

The minimum depth of soil cover over underground outlets shall be 2 feet for mineral soil and 2.5 feet for organic soils where the conduit is not subject to damage by frost action or equipment travel. These minimum depths apply to normal field levels and may exclude sections of line near the outlet end.

The minimum depth of cover for outlets under paved (asphalt and concrete) barnyards shall be at least 1 foot below the bottom of the paving material.

“Guard posts” or other measures shall be provided to protect inlets from damage by livestock or machinery.

VI. Considerations

Additional recommendations relating to design which may enhance the use of, or avoid problems with this practice, but are not required to ensure its basic conservation function are as follows:

- A. Consider effects on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.
- B. Consider effects on the volume of downstream flow that might cause undesirable environmental, social, or economic effects.
- C. Evaluate potential use for water management.
- D. Consider effects on erosion and the movement of sediment, pathogens, and soluble and sediment-attached substances that would be carried by runoff.

- E. Consider effects on the visual quality of downstream water resources.
- F. Consider the construction-related effects on the quality of downstream watercourses.
- G. Consider effects on wetlands or water-related wildlife habitats.
- H. Evaluate potential impact on water quality due to agri-chemicals in outflow.
- I. Consider depth of underground outlet in regard to tillage equipment depth and maintenance, if applicable.

VII. Plans and Specifications

Plans and specifications for installing underground outlets shall be in keeping with this standard and shall describe the requirements for installing the practice to achieve its intended purpose.

VIII. Operation and Maintenance

An Operation and Maintenance Plan shall be provided to and reviewed with the landowner. The plan shall include the following items and others as appropriate.

- A. Keep inlets, orifice plates, trash guards, and collection boxes and structures clean and free of materials that can reduce the flow.
- B. Repair leaks and broken or crushed lines to insure proper functioning of the conduit.
- C. Check outlet conduit and animal guards to ensure proper functioning of the conduit.
- D. Keep adequate backfill over the conduit.
- E. Repair any eroded areas at the pipe outlet.

IX. References

USDA, NRCS, Wisconsin Field Office Technical Guide, Section IV, Conservation Practice Standards and Specifications.